Lehigh University
Lehigh Preserve

Fritz Laboratory Reports

Civil and Environmental Engineering

1951

Notes on the yielding mechanism of flexural members, Oct. 1951

C. H. Yang

NOTES ON

The yielding Mechanism of flexural members.

① Developing and progressing of yielding zones in a bending member.

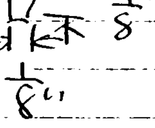
② Slipping planes (Direction of) in Tension and Compression flanges

③ Lower yielding strength of comp. flanges. (same yielding strength in Simple ~~and~~ tension Comp. test)

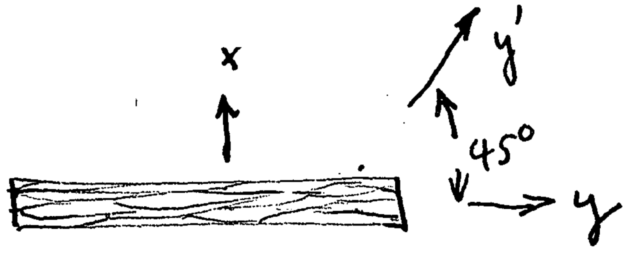
④ Lower bending strength than the prediction

Proposed tests

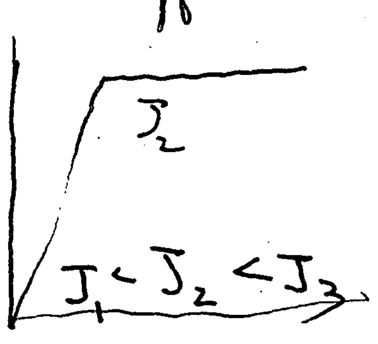
A series of beam test of rectangular beams of different thickness.

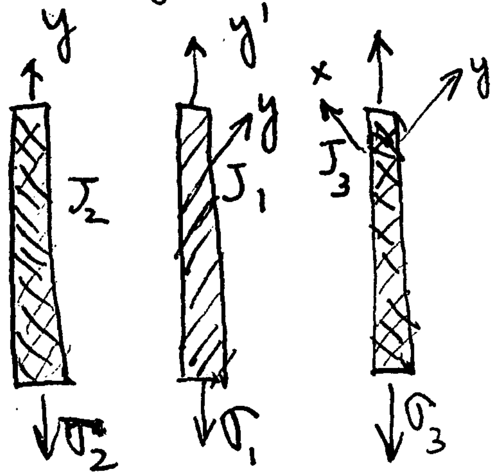
Use 

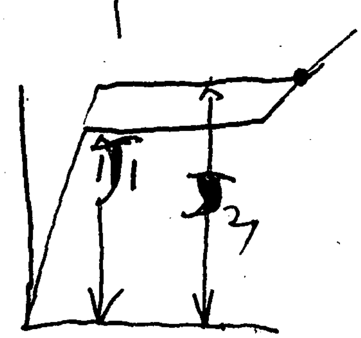
Strain gages.



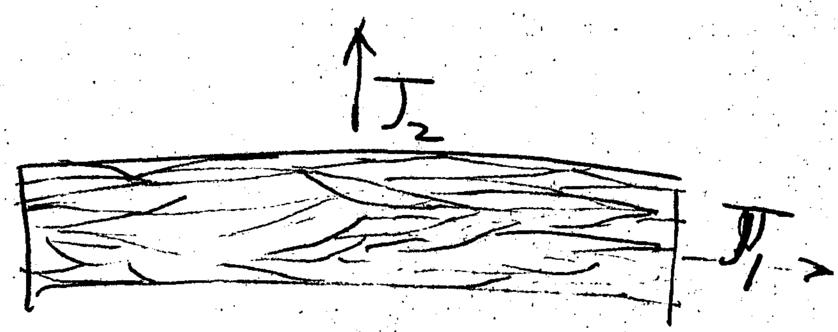
In a rolled section, the grains may be of the above shape. When this is tested in tension or comp. along either x or y direction, the max. shear developed in same sections. They may show the same strength in both directions. But the shearing strength may be different in x & y directions. A tension specimen with white wash, cut along the y' direction may show the difference



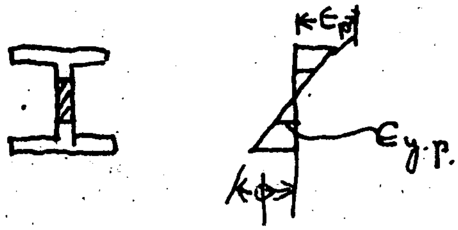


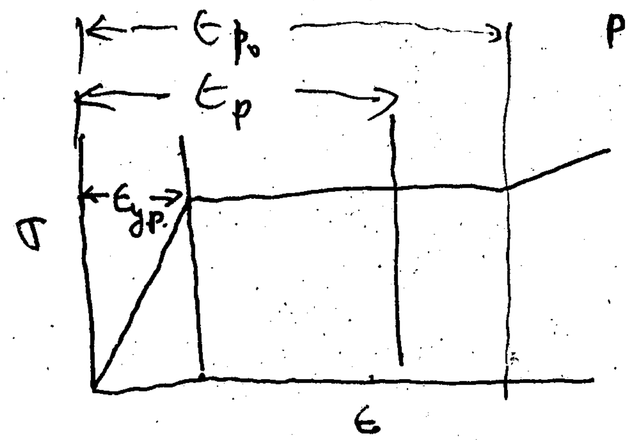


Plastic shear with different yielding strength in two perpendicular directions



$\tau_2 > \tau_1$





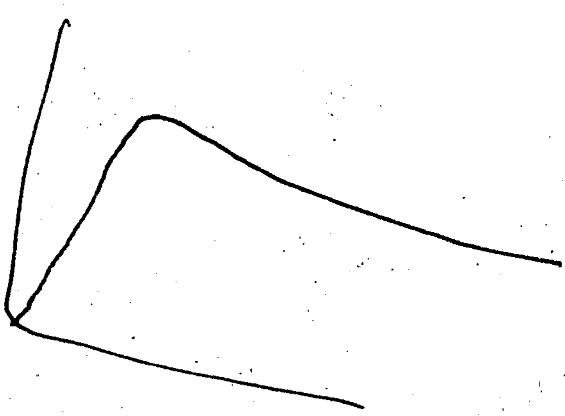
ϵ_p Analytically determined, as function of ϕ.

In actual case ϵ_p is not determined

Plastic strain localized.

This would bring a good point to inelastic buckling problems.

ϵ_{p_0} = 15 to 20 times $\epsilon_{y.p.}$



Oct. 30, 49

1. Shear always started to flow at the corners. But this time it does not see failed by combined stress. Because, the flow lines are perpendicular to each other.

2. M – Φ curves plotted by the gages on web must be compared with the plastic strain on flanges.

3. Plastic strain distribution on a section might ~~be~~ ~~at~~ change the general idea of inelastic buckling of structural steel

In actual metals there must be ~~a~~
a scale effect of plastic flow.
Either of the following tests would
show some information of this prob.

(1) Different thickness plates bend
in plastic range

(2) Short column with initial curvature